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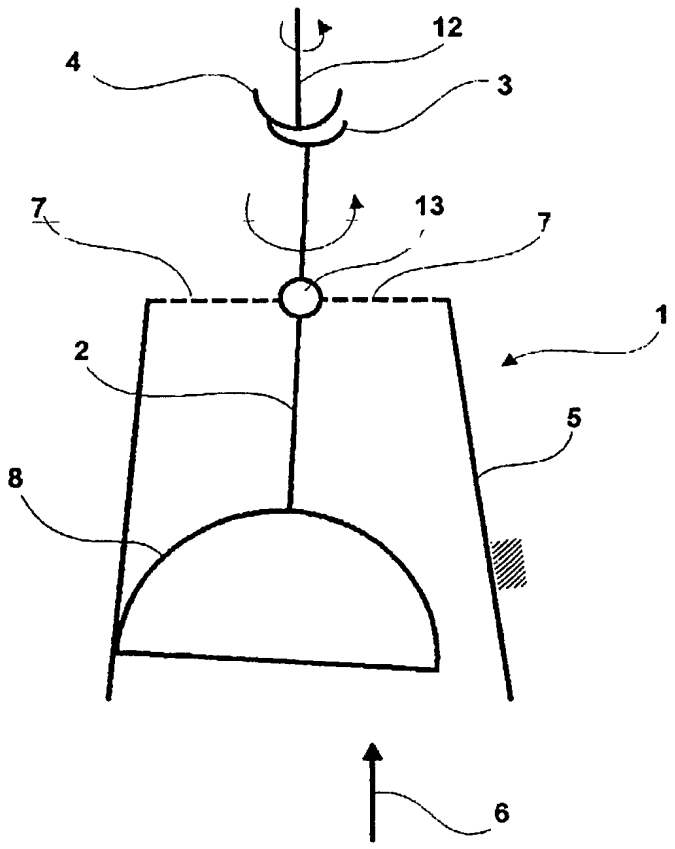
(54) Title: STEP-UP GEARING



(57) Abstract: A multiplier of revolutions comprising a source (1) of a precession motion, from which a rigid procession shaft (2) is protruding, which is provided at its end with the first friction area (3), on which the second friction area (4) is bearing. The axis of the precession shaft (2), at a standstill situation, is coaxial to the verticl axis of the second friction area (4).

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patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

STEP-UP GEARING

Technical Field

The invention relates to a multiplier of revolutions.

Background Art

There exist many known apparati applied for changing revolutions, the principle of which is based on gearings, friction drives and other ones. Besides permanent drives there are known changeable drives, both changeable smoothly or by stages.

With respect to the international application PCT/CZ97/00034 there is known a fluid machine comprising a fluid storage tank, provided with an inlet and at least with one outlet nozzle. In the flow area of the outlet nozzle there is mounted, on a holding device, in a manner enabling free rolling along the inner wall of the outlet nozzle, at least one rolling rotor represented by a body of a rotary shape

From another international application PCT/CZ99/00027 there is known an apparatus for changing revolutions which comprises a stator, the internal diameter of which decreases in the direction of its longitudinal axis, and in the stator there is seated a rolling main satellite which bears against the internal wall of the stator, and the main satellite and/or the stator is seated in an adjustable way in the direction of the longitudinal axis

The technical solution aims to utilize an angle deflection of the rotor shaft of the rolling fluid machine or of the satellite shaft of the device for changing revolutions, which has an appearance of a conical motion, i.e. a precession for the next change of revolutions.

Disclosure of Invention

The mentioned aim can be achieved by means of the revolution multiplier according to the invention, the principle of which resides in the fact that it comprises a source of a precession motion, from which a rigid precession shaft is protruding, which is provided at its end with the first friction area, on which the second friction area is bearing, and the axis of the precession shaft, at a standstill situation, is coaxial to the vertical axis of the second friction area.

The multiplier of revolutions according to the invention makes it possible to multiply original revolutions by means of a simple device, the function of which is based on a completely new and so far unpublished principle.

According to an advantageous embodiments, the source of the precession motion comprises of a liquid container with a rotary internal wall, which is provided with a liquid supply and at least with one off-take. In the longitudinal axis of the liquid container, there is mounted, in a rotary way and swinging one, the precession shaft, the end of which in the liquid container is provided with a rolling rotor, and the opposite end bears the first friction area, on which the second bearing area is bearing.

To make the transfer of final revolutions easier, it is advantageous to connect an outlet shaft to the second friction area

According to an advantageous embodiment, one of the friction areas is of a convex shape, while the second of the friction areas is of a concave shape.

According to another advantageous embodiment, the first friction area is of the shape of an annulus and the second friction area is of a convex shape or the second friction area is formed by a part of a ball.

According to another advantageous embodiment, the second friction area bears vortex elements.

For improving the flow, and in this way also the function of the multiplier of revolutions, it is advantageous, if the flow-off is formed by a drain which has at least one inlet, arranged inside the liquid container and at least one outlet arranged outside the liquid container.

Said drain may be led, at least partially, inside the precession shaft.

According to another advantageous embodiment, the drain is provided with an outlet arranged axially at the end of the precession shaft, and/or it is provided with an outlet arranged on the precession shaft laterally between the first friction area and the second friction area. The second friction area can be formed on a ball, which is freely shifted on the precession shaft. The ball can be provided on its sides with vortex elements.

To achieve a higher variability of a revolution change, it is advantageous, if the rolling rotor is axially adjustable, and if the rotary internal wall of the liquid container is of a conical shape.

Brief Description of the Drawings

The invention will be explained in details with references to drawings, where in Fig. 1 to 3 there are shown three examples of embodiments of the multiplier of revolutions according to the invention, having various embodiments of friction areas.

Modes for Carrying Out the Invention

The multiplier of revolutions according to Fig. 1 comprises of a source 1 of the precession motion which is formed by a rolling fluid machine, known e.g. from the

international patent application PCT/CZ97/00034. The source 1 of the precession motion is provided with a liquid container 5 with a rotary internal wall of a conical shape, which is provided in its lower part with a schematically shown liquid supply 6, and in the upper cover with an off-take 7, comprising of a system of outlet nozzles, concentrically arranged around a suspension joint 13. In the upper cover of the liquid container 5, there is rotatingly and swingingly mounted a precession shaft 2. The name "precession shaft" has been applied to emphasize that this shaft performs a precession motion consisting of a rotation of the shaft around its own axis and of a simultaneous run of a lateral area of a hypothetical cone. One end of the precession shaft 2, viz. the end arranged in the liquid container 5, bears a rolling rotor 8, and the opposite end of the precession shaft 2 bears the first friction area 3 which, as to this example of embodiment, is of a concave shape. The second friction area 4, which is of a convex shape and bears an outlet shaft 12, bears on the first friction area 3. The second friction area 4 is forced against the first friction area 3 either by the own weight of the second friction area 4 with the outlet shaft 12, or by an unshown pushing device. The rolling rotor 8 has the shape of a hollow hemisphere, turned with its open side against the direction of streaming. If no pressure liquid passes through the liquid container, the precession shaft 2 takes a standstill position, and its axis is coaxial with the vertical axis of the second friction area 4 and with the outlet shaft 12.

After having supplied pressure fluid, which may be represented both by a liquid and gas, the rolling rotor 8 starts rolling over the internal wall of the liquid container 5. The mechanism of rise of a circling rolling motion of the rolling rotor 8 is described in details in the mentioned international application PCT/CZ97/00034 and that is why it will be not repeated. It is only needed to stress that during the rolling there does not occur any considerable sliding between the rolling rotor 8 and the internal wall of the liquid container 5. The rolling of the rolling rotor 8 results in a precession motion of the precession shaft 2, and in this way a precession motion of the first friction area 3 as well. The second friction area 4 copies the precession motion of the first friction area 3, and revolutions of the inlet shaft 12 are higher than revolutions of the precession shaft 2.

The mutual pressure of the first friction area 3 and of the second friction area 4 is such that it may make it possible, at the precession motion, to transfer a torsional moment by friction in the spot of their contact. Then the outlet shaft 12 rotates in a velocity which represents the precession velocity, i.e. the circulation velocity of the rolling rotor 8 in the liquid container 5, and the rotation velocity of the precession shaft 2, i.e. the proportion between the diameter of the rolling rotor 8 and the internal wall of the liquid container 5 in the spot of their contact. By diminishing the difference between the diameter of the rolling rotor 8 and the internal wall of the liquid container 5 in the spot of their contact, there is achieved a higher number of rolling for one turn of the rolling rotor 8, which results in a slower rotation of the precession shaft 2 and vice versa.

By means of measuring, it was found out that by a diameter of the rolling rotor 8 of the value of 37,0 mm, which rolls over the diameter of 38,3 mm of the internal wall of the liquid container 5, and by supplying pressure water of 7,0 kPa, the precession shaft 2 rotates in a velocity of 30 rpm. The concave first friction area 3, the rounding off radius of which being R = 5 mm, has the largest radial diameter in the value of 8 mm, and the second friction area 4 has its rounding off diameter R = 15 mm and the largest radial diameter = 15 mm. When combining revolutions and the precession motion of the precession shaft 2, revolutions are multiplied, so that the outlet shaft 12 rotates in a velocity of 130 rpm.

In Fig. 2, there is shown another exemplary embodiment of the multiplier of revolutions according to the invention. In this case it concerns a room air humidifier, a freely laid ball 9 of which has higher revolutions than the precession shaft 2 and it serves to a simple signalling of the humidifier function. On sides of the ball 9 there are fixed vortex elements 20 which, in this embodiment, are curved as airscrew blades. A source 1 of the precession motion is the same as in the embodiment according to Fig. 1, i.e. a rolling fluid machine, known from the international application PCT/CZ97/00034. It comprises again of the liquid container 5 with the internal area of

a conical shape and liquid supply 6. In the upper cover it is provided with an off-take 7, formed by a system of holes. The precession shaft 2 passes through the central hole in the upper cover and it bears on a step 11. On the other side of the cover, the precession shaft 2 is locked against falling out by means of an extension piece 10, on the upper part of which there is made the first friction area 3 in the shape of an annulus. So the precession shaft 2 is mounted in a rotating way and at the same time in a swinging way too. The rolling rotor 8, as in the embodiment according to Fig. 1, is of the shape of a hollow hemisphere, turned with its open part against the direction of streaming. The second friction area 4 which is formed by a part of the ball 9, being pressed to the first friction area 3 only by its own weight, bears on the first friction area 3.

The function is analogous as in the embodiment according to Fig. 1. After pressure water has been supplied, the rolling rotor 8 starts rolling over the internal wall of the liquid container 5. Water leaving the liquid container 5 through the system of holes of the off-flow 7, humidifies air in a room, and flows away to an unshown tank under the liquid container 5. The precession motion of the precession shaft 2, and in this way even the precession motion of the concave first friction area 3, is the result of rolling of the rolling rotor 8. The ball 9 rolls over the first friction area 3, and revolutions of the ball 9 are higher than revolutions of the precession shaft 2. Vortex sheets 20, curved as airscrew blades, are fixed to the ball 9, and that is why they have the same revolutions. So they cause air turbulences and help that liquid leaving the liquid container 5 may evaporate, which is especially advantageous, if aromatic or healing essences, used e.g. for healing asthmatics, are included in the circulating liquid.

Another exemplary application of the multiplier of revolutions according to the invention, when designing a room humidifier, is illustrated in Fig. 3. This embodiment differs a little with respect to the embodiment illustrated in Fig. 2. The off-flow 7 is not formed by a system of holes, but by a drain 23, formed in the upper end of the precession shaft 2. The drain 23 is provided with a laterally orientated inlet 21, arranged inside the liquid container 5. It has also three outlets 22 which are directed

out of the precession shaft 2 in the area which lies outside the liquid container 5. The first outlet 22 is orientated axially at the end of the precession shaft 2, the second outlet 22 is directed from the precession shaft 2 laterally to the area between the first friction area 3 and the second friction area 4, and the third outlet is directed from the precession shaft 2 laterally to the area between the first friction area 3 and the cover of the liquid container 5.

The second friction area 4 is formed by the lower part of the ball 9. The ball 9 is provided with a through hole 24, by means of which it is freely slid on the precession shaft 2, and onto their sides there are fixed vortex elements 20 in the shape of airscrew blades.

The device function is analogous to the function of the embodiment shown in Fig. 2. The difference resides in fact only in realizing the off-flow 7, i.e. in directing the liquid leaving the liquid container 5. As to the embodiment shown in Fig. 3, a part of liquid leaves the liquid container 5 through the first outlet 22 at the end of the precession shaft 2, and it is sprayed both by pressure and because of the precession motion. This fact, together with increased revolutions of vortex areas 20, supports, as to the room air humidifier, the mixing of drops of the leaving liquid with air. Another part of liquid leaves the liquid container 5 through the second outlet 22 into the area between the first friction area 3 and the second friction area 4, and in this way it improves their mutual motion. The remaining part of liquid leaves the liquid container 5 through the third outlet 22 between the first friction area 3 and the cover of the liquid container 5.

When designing a multiplier of revolutions according to the invention, any source 1 of the precession motion may be utilized, not only a rolling fluid machine, illustrated with respect to the embodiments according to Figs. 1 to 3. This rolling fluid machine may be replaced with any suitable drive, the outlet shaft of which performs a precession motion.

The rolling rotor 8 may be of arbitrary rotation shape. It is also not essential which of

the bearing surfaces 3, 4 has a concave shape and which a convex one. Bearing surfaces 3, 4, may also have another suitable shape, e.g. annulus - convex surface.

Liquid containers 5, as to the embodiments according to Figs. 1 to 3, have their internal wall of a conical shape. By shifting the rolling rotor 8 in the direction of the longitudinal axis, the character of the precession motion can be changed, and in this way final revolutions can be affected.

Finally it may be stressed that the multiplier of revolutions according to the invention can be applied always, if it is needed to multiply basic revolutions.

CLAIMS

1. A multiplier of revolutions **characterized by** the fact that it comprises a source (1) of a precession motion, from which a rigid precession shaft (2) is protruding, which is provided at its end with the first friction area (3), on which the second friction area (4) is bearing, and the axis of the precession shaft (2), at a standstill situation, is coaxial to the vertical axis of the second friction area (4).

2. The multiplier of revolutions as in Claim 1, **wherein** the source (1) of the precession motion comprises of a liquid container (5) with a rotary internal wall, which is provided with a liquid supply (6) and with at least one off-take (7), and in the longitudinal axis of the liquid container (5) there is mounted, in a rotary and swinging way, the precession shaft (2), the end of which in the liquid container (5) is provided with a rolling rotor (8), and the opposite end bears the first friction area (3), on which the second friction area (4) is bearing.

3. The multiplier of revolutions as in Claim 1 or 2, **wherein** an outlet shaft (12) is connected to the second friction area (4).

4. The multiplier of revolutions as in Claims 1, 2 or 3, **wherein** one of the friction areas (3, 4) is of a convex shape, while the second of the friction areas (3, 4) is of a concave shape.

5. The multiplier of revolutions as in Claim 1, 2 or 3, **wherein** the first friction area (3) is of the shape of an annulus and the second friction area is of a convex shape.

6. The multiplier of revolutions as in Claim 4 or 5, **wherein** the second friction area (4) is formed by a part of a ball (9).

7. The multiplier of revolutions according to any of the Claims 1 to 6, **wherein** the second friction area (4) bears vortex elements (20).

8. The multiplier of revolutions according to any of the Claims 2 to 7, **wherein** the off-take (7) is formed by a drain (23), which is provided at least with one inlet (21) arranged inside the liquid container (5), and at least with one outlet (22) arranged outside the liquid container (5).

9. The multiplier of revolutions as in Claim 8, **wherein** the drain (23) is led, at least partially, inside the precession shaft (2).

10. The multiplier of revolutions as in Claim 9, **wherein** the drain (23) is provided with the outlet (22) arranged axially at the end of the precession shaft (2), and/or it is provided with the outlet (22) arranged on the precession shaft (2) laterally between the first friction area (3) and the second friction area (4), while the second friction area (4) is formed on the ball (9), which is freely shifted on the precession shaft (2), and the ball (9) is provided on its sides with vortex elements (20).

11. The multiplier of revolutions according to any of the Claims 2 to 10, **wherein** the rolling rotor (8) is axially adjustable, and the rotary internal wall of the liquid container (5) is of a conical shape.

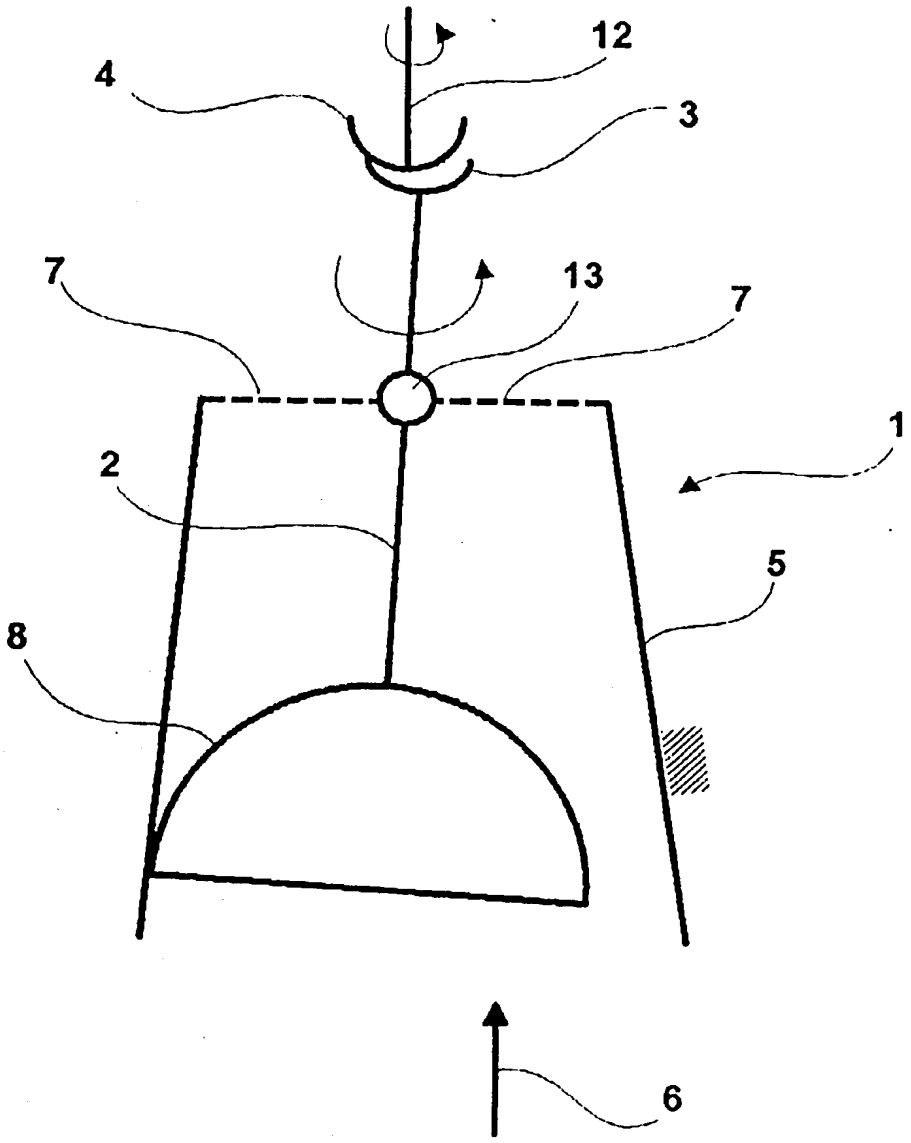

Fig. 1

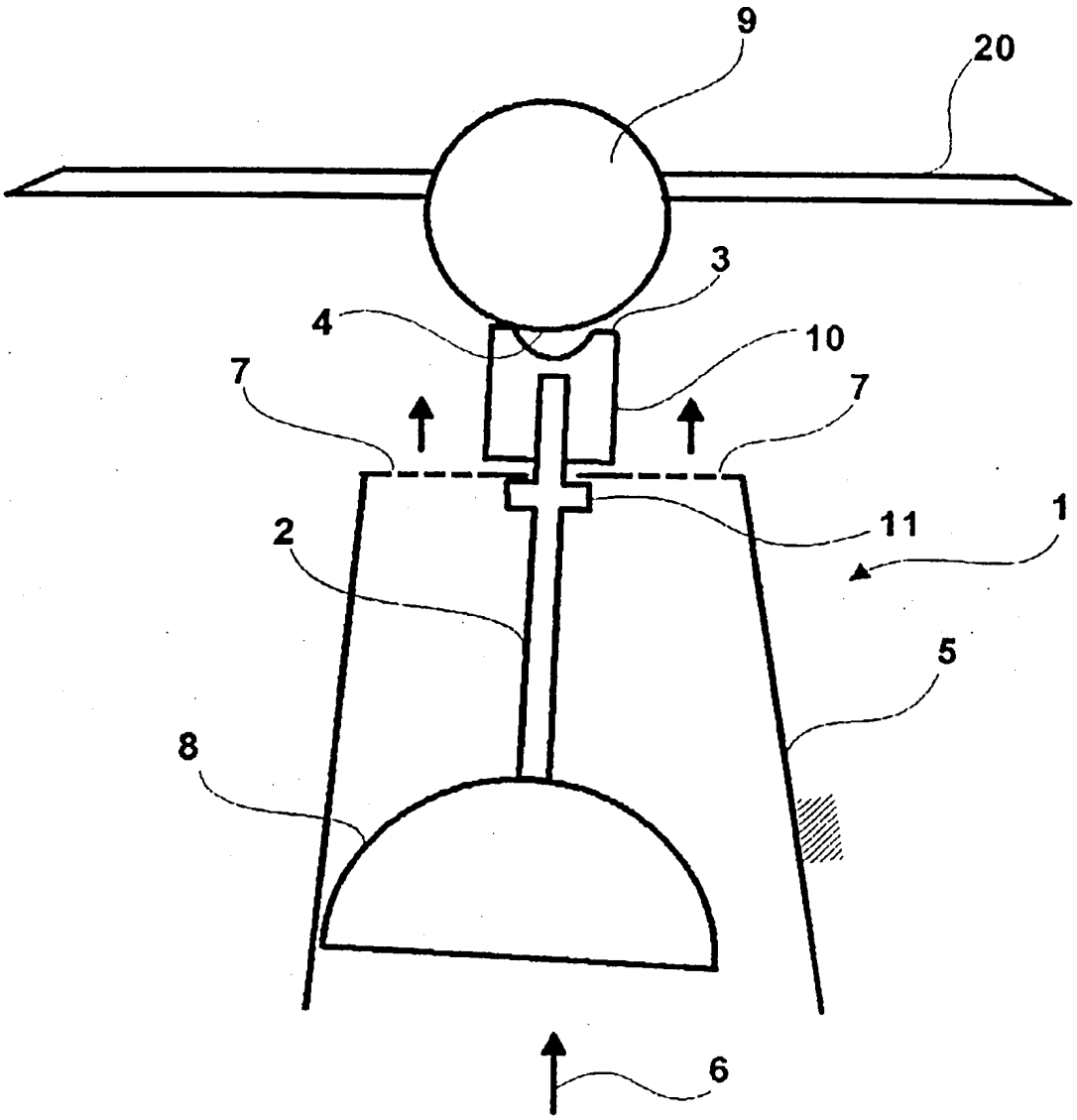

Fig. 2

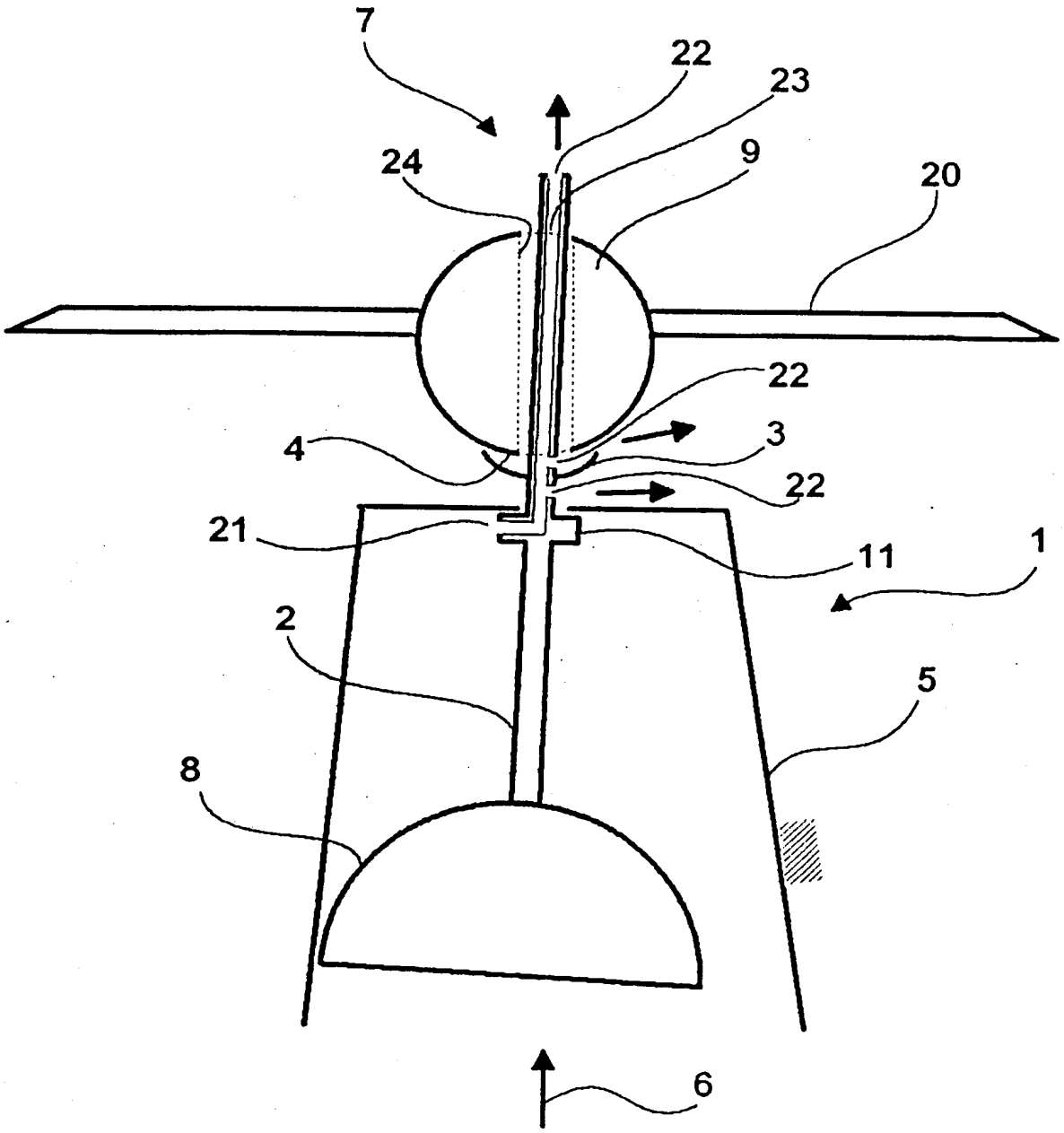

Fig. 3

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/CZ 00/00088

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16H13/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 227 004 A (ORAIN) 4 January 1966 (1966-01-04) column 1 -column 7; figures 1-20	1,3
A	US 4 713 977 A (PHILIPHS) 22 December 1987 (1987-12-22) column 1 -column 3; figure 1	1,3
A	GB 564 395 A (BENNION) 19 January 1946 (1946-01-19) the whole document	1
A,P	US 6 139 267 A (SEDLACEK) 31 October 2000 (2000-10-31) cited in the application abstract; figure 1	1,2

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 March 2001	21/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Flores, E

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

In. ational Application No
PCT/CZ 00/00088

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A,P	WO 00 08358 A (HOSTIN) 17 February 2000 (2000-02-17) cited in the application abstract; figure 1	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Ir. ational Application No
PCT/CZ 00/00088

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 3227004	A	04-01-1966	NONE		
US 4713977	A	22-12-1987	NL	8503140 A	01-06-1987
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WO 0008358	A	17-02-2000	AU	4895399 A	28-02-2000

DERWENT-ACC-NO: 2001-398227

DERWENT-WEEK: 200206

TITLE: Revolution multiplier, e.g. for a room air humidifier, in which liquid flowing through a conical container causes a shaft fixed to a rolling rotor to perform a precession motion to rotate an outlet shaft via engaging friction areas

INVENTOR: SEDLACEK M

PATENT-ASSIGNEE: HOSTIN S[HOSTI] , SEDLACEK M[SEDLI]

PRIORITY-DATA: 1999CZ-004624 (December 17, 1999)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE
WO 0144688 A1	June 21, 2001	EN
AU 200113796 A	June 25, 2001	EN
CZ 9904624 A3	December 12, 2001	CS

DESIGNATED-STATES: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL T J TM TR TT TZ UA UG US UZ VN YU ZA ZW AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
WO2001044688A1	N/A	2000WO-CZ00088	November 28, 2000
CZ 9904624A3	N/A	1999CZ-004624	December 17, 1999
AU 200113796A	Based on	2001AU-013796	November 28, 2000

INT-CL-CURRENT:

TYPE	IPC DATE
CIPS	F16H13/06 20060101

ABSTRACTED-PUB-NO: WO 0144688 A1

BASIC-ABSTRACT:

NOVELTY - The multiplier uses a rolling fluid machine in which a conical shape container (5) provides a rotary surface for a rolling rotor (8), i.e. hollow hemisphere, fixed to a precession shaft (2) mounted to a suspension joint (13). The shaft performs a precession motion as liquid flows between a supply (6) and off-take (7). The shaft has a friction area (3) that bears on a friction area (4) fixed to an outlet shaft (12) causing the outlet shaft to revolve faster than the precession shaft.

USE - Revolution multiplier for rotating an outlet shaft in a device, e.g. a room air humidifier.

ADVANTAGE - Provides a simple device based on a completely new principle for multiplying shaft revolutions. The friction areas can have various

shapes, e.g. concave and convex or part ball-shaped, and can include vortex elements to form the room air humidifier. Liquid/air mixing is enhanced by spraying liquid out through the end of the precession shaft. The rolling rotor is adjusted axially to change the precession motion.

DESCRIPTION OF DRAWING(S) - The drawing shows a schematic view of the revolution multiplier.

Precession shaft (2)

Precession shaft friction area (3)

Outlet shaft friction area (4)

Conical shape container (5)

Liquid supply (6)

Liquid off- take (7)

Rolling rotor (8)

Outlet shaft (12)

Suspension joint. (13)

CHOSEN-DRAWING: Dwg.1/3

TITLE-TERMS: REVOLUTION MULTIPLIER ROOM AIR HUMIDIFY LIQUID FLOW THROUGH CONICAL CONTAINER CAUSE SHAFT FIX ROLL ROTOR PERFORMANCE PRECESSION MOTION ROTATING OUTLET ENGAGE FRICTION AREA

DERWENT-CLASS: Q64

SECONDARY-ACC-NO:

Non-CPI Secondary Accession Numbers: 2001-293480